MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

BEM1014 – MATHEMATICS

(All sections / Groups)

10 OCTOBER 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **6 pages** including cover page and mathematical formulas with **4 questions** only.

2. Attempt **ALL** questions and write your answers in the Answer Booklet provided.

3. Students are allowed to use non-programmable scientific calculators that are permitted to be used in the examination.

Question 1 (25 Marks)

a) The expenditures of a household on consumer goods, C, is related to the household's income, I, in the following way: when the household's income is \$1000, the expenditures on consumer goods is \$900, and whenever income increases by \$100, the expenditures on consumer goods increases by \$80. Express the expenditure on consumer goods as a function of income, assuming a linear relationship.

[5 marks]

b) If the profit P (in RM) earned by selling x units of some item is given by the equation

$$P = -3x^2 + 200x - 2000$$

(i) Find the quantity of item (to the nearest integer) which produces a profit of \$1000.

[3 marks]

(ii) Find the quantity of item (to the nearest integer) which produces a break-even situation.

[3 marks]

c) Consider the market for pineapples in a small island nation. The domestic demand curve is $p = 60 - 3q$ and the domestic supply curve is $p = 10 + 2q$.

(i) What is the market equilibrium price and quantity?

[3 marks]

(ii) If the government imposes tax of \$0.25 per pineapples on the supplier, how will the original equilibrium price be affected if the demand quantity remains the same?

[7 marks]

(iii) Determine the total revenue obtained by the pineapples supplier at the equilibrium point both before and after the tax.

[4 marks]

Continued....

Question 2 (25 Marks)

a) Write down the **Objective Function** and the **Constraints** for the following linear programming problems:

i. A farmer has 80 hectares of his farm available for planting maize and cabbages. He must grow at least 10 hectares of maize and 20 hectares of cabbages to meet demands. He prefers to plant more cabbages than maize but his workforce and equipment will only allow him to cultivate a maximum of three times the quantity of cabbages to that of maize. The farmer would like to plant the two crops to make a maximum profit whereas the profit on maize is $800 per hectares and on cabbages $500 per hectares.

[6 marks]

ii. A farming cooperative mixes two brands of cattle feed. Brand X costs $25 per bag and contains 2 units of nutritional element A, 2 units of element B, and 2 units of element C. Brand Y costs $20 per bag contains 1 unit of nutritional element A, 9 units of element B, and 3 units of element C. They would like to find the number of bags of each brand that should be mixed to produce a mixture having a minimum cost per bag. The minimum requirements of nutrients A, B and C are 12 units, 36 units and 24 units, respectively.

[5 marks]

b) A factory makes two types of beds, type A and type B. Each month x of type A and y of type B are produced. Given that the profit on type A bed is RM300 and the profit on type B bed is RM150. The following constraints control monthly production:

$$0 \le x \le 50$$
$$0 \le y \le 40$$
$$x + y \ge 60$$
$$x + y \le 80$$

How many of each type of bed must be produced per month to maximize profit? What is the maximum profit?

[14 marks]

Continued...

Question 3 (25 Marks)

a) Consider the following nominal interest rate:
- 16.8 % with interest paid annually
- 16.4 % with interest paid monthly
- 16.5 % with interest paid quarterly

(i) Determine the effective annual interest rate of each of the above nominal rate.

[5 marks]

(ii) Which is the best interest rate for an investment? Which is the best for a loan?

[2 marks]

b) Ronald invests money in a project which triples his money in 20 years. Assuming annual compounding of interest, what is the rate of interest?

[5 marks]

c) Franklin's used car cost $13,000. After his down payment of $2000, he financed the remainder at 6% for 4 years. If the monthly payment on his loan is $258.39, how much interest will Franklin pay over the term of the loan?

[6 marks]

d) You have a retirement account with RM2000 in it. The account earns 6.2% interest, compounded monthly, and you deposit RM50 every month for the next 20 years. How much will be in the account at the end of those 20 years?

[7 marks]

Continued...

Question 4 (25 Marks)

a) Solve the following derivatives:

(i) $y = (2x^2 + 1)^4 (\frac{1}{3}x - 2)^3$ [3 marks]

(ii) $y = \sqrt[7]{x^2 + 7x^7}$ [2 marks]

b) A producer sells two commodities, x units of one commodity and y units of the other. Suppose the revenue from the sale is given by the equation $R(x, y) = 6x^2 - 24y$ and the cost function is given by $C(x, y) = -4y^2 - 30x - 20$. Determine the minimum profit of the sale (in dollars).

[7 marks]

c) Evaluate the following integral:

(i) $\int 3t^{-4}(2 + 4t^{-3})^{-7}\, dt$ [4 marks]

(ii) $\int_1^3 (3x^2 - 4x + 2e^x - \frac{7}{x} + 5)dx$ [3 marks]

d) Determine the area between the top curve $g(x) = 2x$ and the below curve $f(x) = 2x^2 - 4$ where both curves meet at two particular points.

[6 marks]

Continued...

Course: Mathematics
Code: BEM 1014

Summary of Principal Formulas and Terms

Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)
(ii) Accumulated amount, $A = P\,(1 + rt)$

Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$
(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$ (S = future value of ordinary annuity of n payments of R dollars periodic payment)

Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$ (P = present value of ordinary annuity of n payments of R dollars periodic payment)

Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$ (R = periodic payment on a loan of P dollars to be amortized over n periods)

Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$ (R = periodic payment required to accumulate S dollars over n periods)